DRIVETRAIN TESTING

E-POWERTRAIN LAB

Location: Flanders Make - Lommel

DESCRIPTION

Up to green and smart mobility

Vehicle manufacturers are under considerable pressure to shift away from fossil fuels. In future, electric vehicles will dominate the streets. Nevertheless, we still need plenty of research before electric drives will have gained the confidence of the general public and completely replace conventional combustion engines. Among others, the range and cost of the battery are still major issues.

To anticipate the trend towards ever increasing flexibility, more and more electric drives are being integrated in machines. Currently, very comprehensive and thus time-consuming and cost-intensive tests on machine prototypes are necessary to analyse the robustness and energy efficiency of these drives.

In the E-Powertrain Lab, we test components for energy-efficient vehicles and machines. The infrastructure integrates hardware in-the-loop (HiL) facilities that enable companies to accelerate the development of new products. Drivetrain components can here be tested in an early stage in realistic conditions without having to integrate them in a vehicle or machine. This accelerates the design process, reduces the number of tests that must be performed on the end product and has most definitely a positive impact on the costs.

Realistic tests in a virtual world

A key component of every electric car is the battery pack. It is very important to compose the best possible battery pack. However, battery cells are expensive. Therefore, vehicle manufacturers will first finalise the software and control algorithms of the Electronic Control Unit (ECU) before testing them with real hardware. Flanders Make has disposal of a dynamometer test bench with an electric motor that emulates the resistance from both the air and the road surface. Because, obviously, you must know if the motor, for which the ECU controls the energy flow, can generate sufficient power to keep the vehicle in motion or to slow it down. The test bench allows to simulate up to 20,000 revs per minute, with a maximum mechanical power of 320 kW.

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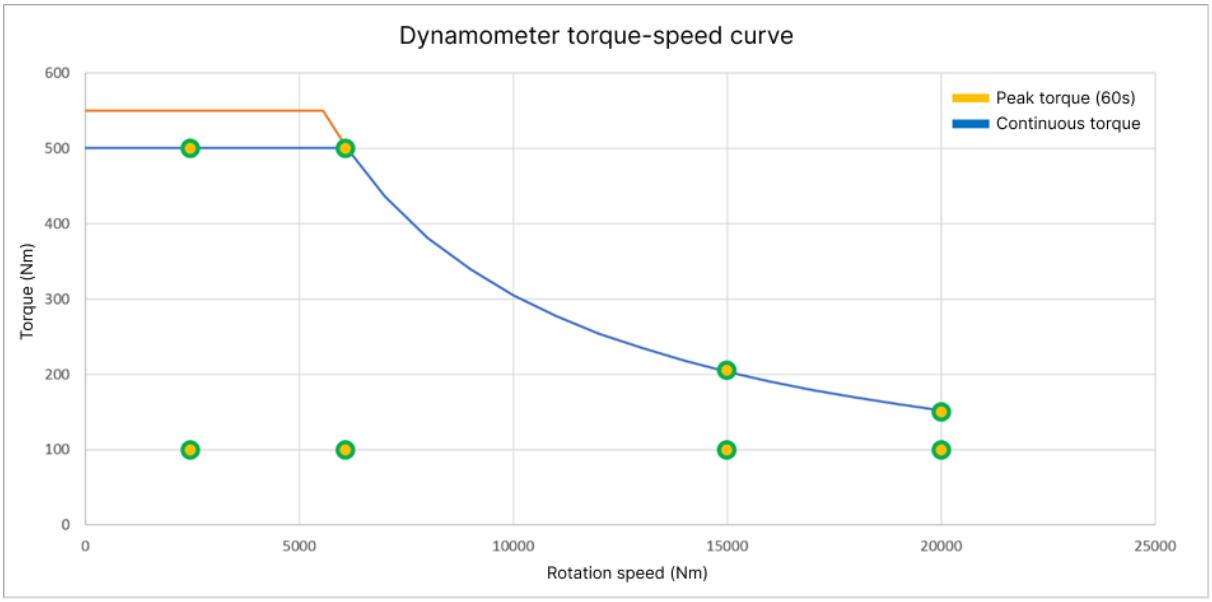
Furthermore, this test bench can also be used to test electric motors that, in the end, are incorporated in various machine applications. In view of validating these applications, the software is customised so that the motor genuinely believes to be present in the machine, for instance in the drive of a weaving machine.

Hardware in-the-loop allows to emulate the charging / discharging cycle of the battery in a wide variety of conditions using a virtual battery model. This means that the infrastructure generates voltages and currents. In this way, the load on the battery pack is simulated as it would behave in a real vehicle. The voltages and current limits are physically linked to the electric motor to examine the interaction between battery and motor and optimise the control. As a result, we can realistically assess the performance of the whole powertrain (battery pack, inverter and motor).

The lab also allows to perform endurance and ageing tests on battery packs. If needed, these tests can be performed in a climate chamber (with temperatures ranging from -40°C to +180°C and an air humidity from 15% to 98%). This enables to validate a battery pack under a wide variety of conditions so that the right battery cell for a specific application can be validated.

Next to testing battery packs, inverters and electric motors, the hardware in-the-loop infrastructure also allows to perform tests on ECUs. As such, many different applications other than electric vehicles can be tested in the lab. The computer can be programmed so that different charging cycles of electric motors and their corresponding electronics for machines and/or other applications can be safely tested and validated.

TECHNICAL SPECIFICATIONS



TECHNICAL SPECIFICATIONS - BATTERY-EMULATOR

Number of channels	4
Mode	Current source or voltage source (DC)

Voltage range	0 V – 1500 V
Current range	270 A per channel (1080 A in parallel)
Power range	135 kVA per channel (540 kVA in parallel)
Communication	CAN bus
Programmable	Voltage or current as a function of time.
Data-logging	Yes, 8 CAN bus ports available

TECHNICAL SPECIFICATIONS - CLIMATE CHAMBER

Temperature range	-60...130 °C
Humidity range	10...98 %
Dew point range	+5...79 °C
Test volume	5.6 m·
Test dimensions	1500 x 2500 x 1500 mm
Communication	RS-232
Programmable	Temperature and/or humidity as a function of time.
Additional systems	CO-sensor, CO2 extinguishing system, door lock

TECHNICAL SPECIFICATIONS - COOLING SYSTEM

Liquids	Water/glycol, thermal oil
Fluid temperature	-50...220 °C
Ambient temperature	5...40 °C
Temperature stability	0,05 ±K
Power	Heating: 5,3 kW Cooling: 7 kW at 100 °C and 200 °C with thermal oil Cooling: 7 kW at 10 °C and 20 °C with ethanol
Maximum pump pressure	2,9 bar
Maximum flow rate	45 L/min
Communication	RS-485

TECHNICAL SPECIFICATIONS - DATA-ACQUISITION

Power analyzer	Infratek 108A
Bandwith	Up to 2 MHz (DC)
Measuring resolution	18 bit
Voltage measurement	6 channels
Current measurement	6 channels
Additional I/O	Various possibilities

POSSIBLE HARDWARE COMBINATIONS

	Dynamometer	Battery emulator	Climate chamber
Standalone	X	X	X
Dynamometer		X	

Battery emulator	X		X
Climate chamber		X	

OUR OFFER

- Hardware-in-the-Loop facilities that enable companies to accelerate the development of new products.
- Testing of drivetrain components in an early stage in realistic conditions without having to integrate them in a vehicle or machine.
- For acceleration of the design process, reduction of the number of tests that must be performed on the end product and a positive impact on the costs.